

Estrategia pedagógica para el desarrollo de la cultura ambiental hacia la protección del recurso agua

Pedagogical strategy for the development of environmental culture towards the protection of the water

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RESUMEN: El presente artículo tuvo como objetivo la instrumentación de una estrategia pedagógica para desarrollar la cultura ambiental con vista a contribuir a la protección del recurso agua por los maestros en formación del Centro Universitario Municipal de San Luis, provincia Santiago de Cuba. Para su desarrollo se utilizaron métodos teóricos y empíricos conjuntamente con el Sistémico Estructural Funcional. Los resultados fueron favorecedores revelando la efectividad de la estrategia al lograrse la cultura ambiental con los conocimientos y habilidades necesarias para la adecuada protección del recurso objeto de estudio dando solución de esta manera a un problema de la práctica educativa posibilitando además el enriqueciendo de las Ciencias de la Educación.

Palabras clave: Centro universitario municipal; Educación ambiental; Maestros en formación y protección de recursos naturales

ABSTRACT: This article aimed at the instrumentation of a pedagogical strategy to develop the environmental culture with a view to contributing to the protection of the water resource by the teachers in training of the Municipal University Center of San Luis, province of Santiago de Cuba. For its development, theoretical and empirical methods were used together with the Functional Structural System. The results were favorable, revealing the effectiveness of the strategy by achieving environmental culture with the knowledge, skills necessary for the adequate protection of the resource under study providing a solution in this to a problem of educational practice also enabling the enrichment of education sciences

Keywords: Municipal university center; Environmental education; Teachers in training and protection of natural resources

Introduction

Environmental education is essential to empower people with the knowledge and attitudes necessary to make responsible decisions about the natural environment on this planet with growing challenges and problems that in one way or another affect the quality of life of all living beings, a situation that has become a pillar to inspire actions in favor of the environment.

One cannot live with one's back to the world. "Environmental education is the fundamental basis for the achievement of the objectives of sustainable development and for the conservation of natural resources worldwide" (Water, 2021, p. 81).

In order to support the development of this and with it the protection of the environment and natural resources, the United Nations (UN) (2023) has tried to raise awareness in this regard. In this direction, the speech at the Earth Summit held in Rio de Janeiro, when the Cuban president at that time said: "Let human life become more rational. Let a just international order be applied. Use all the science necessary for sustained development without pollution. Let the ecological debt be paid, not the foreign debt. Let hunger disappear and not man" (Castro Ruz, 1992, p. 3).

Through environmental education, it seeks to form individuals capable of making informed and responsible decisions in relation to the environment. The Ministry of Environment and Sustainable Development of Colombia emphasized the following: "Environmental education is a dynamic and participatory process oriented to the formation of critical and reflective individuals, with capacities to understand the environmental problems of their local, regional and national contexts" Muhamad (2021). She explained the importance of youth at a global level to fight climate change.

Once environmental education has been worked on, its essence lies in forming an environmental culture, which according to the authors of this paper refers to the set of values, beliefs, attitudes and practices related to the protection and conservation of the environment.

In this regard, the National Water Commission of Mexico (2021) stated:

Water Culture is a set of values, attitudes, customs and habits that are transmitted to an individual or a society to create a responsible awareness about the rational use, the importance of water for the development of every living being, the availability of the resource in its environment and the actions necessary to obtain it, distribute it, dislodge it, clean it and reuse it. (p. 2)

It implies a deep connection and active concern for the protection of natural resources and the promotion of sustainability. "The current environmental crisis demands concrete actions to foster an environmental culture in society" (Betancourt &Correa, 2021, p. 121).

An environmental culture is urgently required to rethink the habits and behaviors of all human beings, actions that materialize in favor of the environment and all forms of life, understood as a

process that starts from the analysis of environmental problems and offers proposals that should be aimed at identifying the degree of environmental knowledge, attitudes or representations that groups of school or university students have about the state of the environment. (Medina & Páramo 2014, p. 54)

In all this process, which is pedagogically oriented, it is largely about protecting one of the most valuable resources, water, which is a strategic action to ensure human and ecological well-being in the face of global challenges such as climate change, population growth or water scarcity. It implies the efficient and rational use of water resources in terms of both quantity and quality. “Environmental education has foundations that allow the protection of water” (Water, 2021).

There are many criteria about the use of water, in this sense to connote the importance it has since not all human beings act with due awareness in this regard.

Water, as the most vital resource for our existence, is a vector of development and an indicator of people's quality of life. Therefore, its conservation and care is crucial from all perspectives, where environmental education plays a fundamental role. (Zarza, 2021, p. 1)

Environmental culture is developed through education, personal experience and interaction with the environment. It should be taken into account that the promotion of this type of culture can be built in the individual from early stages of his or her formation, which means that water protection requires an integral and integrated management that involves all social and institutional sectors related to water. (Orduña, 2024, p. 6)

However, it does not consider the transition from the theoretical level, that is, from the simple disposition towards a transforming behavior, consistent with what has been received, which shows the balance between the internal and the external, taking into account that the student can be apt to do and not do it.

In light of the above, educational institutions have the opportunity, but also the duty, to educate committed, critical and active citizens capable of leading sustainable lifestyles and exerting a positive influence on their families and communities. It is in this context where education emerges as a powerful, transforming, encouraging and optimistic tool; capable of sowing the seeds of change and cultivating a new environmental awareness, through the effective and deep incorporation of environmental education in the curricula with teaching methodologies coherent with the present and the seriousness of the environmental crisis. (United Nations (UN), 2023).

These aspects are considered important to deploy a positive action aimed at environmental protection where water is prioritized for being the one that gives life, starting from the formation of environmental culture as a fundamental space in which the performance of this student will take place in interaction with other biotic, abiotic and socioeconomic factors, abiotic and socioeconomic factors, in a repeatable time, which requires considering it as cognitive, educational and developmental in a totalizing sense and its concretion in a way of acting for individual and social transformation. (Ortuste, 2022, p.15)

The environmental culture for the protection of water resources, will allow learning to acquire a complex character, where students are able to critically analyze various social and environmental problems, however “argumentation has been little developed in primary and secondary school contexts, placing it then in a priority practice in higher education, which justifies the various difficulties in training children and young people” (Zona & Marquez, 2019, p. 81).

Correspondingly, the Curricular Strategy of environment or environmental education (Universidad de Oriente, 2015), refers to the need for a holistic approach during the treatment to environmental issues; more when there are problems in this sense natural and social related to the modes of behavior, however, despite the demands in the pedagogical practice there are insufficiencies in correspondence between the theoretical knowledge that students possess and the behavior they assume in favor of the care and protection of water in the environments where they perform their teaching practice activities. (Maydata, 2017, p. 12)

From educational research, it is necessary to contribute to the development of an environmentalist culture in primary teachers in training, with the objective of generating environmental awareness and commitment from the initial stages of their professional training. In this direction in the Professional Model of the Bachelor's Degree in Primary Education (Study Plan D, 2010). For Martínez (2016), as for many, the vision of possessing an environmental culture is essential; they state: “it is oriented in the general objectives, that the student is capable of acquiring a system of knowledge, habits and skills related to environmental education in a reflective and valuate way” (p. 51).

In view of the above, the Study Plan D is also outside the central unit, also fulfilling the development of the Bachelor's Degree studies which are developed in the municipalities through the courses by meetings in the Municipal University Centers (CUM) and also through the

daytime activities in the “Casas Madres” in the main cities of the provinces, which facilitates that once graduates can have the belief given their academic training to protect the water resource using the combination of theory and practice from their own way of feeling, and act, favoring an adequate professional performance: urban and rural contexts that do not cease to be their spheres of action.

In the opinion of the authors of this article, at the present time, the training of university students in pedagogical careers acquires greater relevance, due to the transformations taking place in the university itself, in primary education, for which they are being prepared and in the society in which they are developing. The importance of this whole research process coupled with the development of research by other authors on the same problem about the formation of environmental culture for teachers in training lies precisely in the intention of having a working tool for further research in which it is necessary to use the proposed strategy with its phases and evaluative indicators where it is accessible for its introduction and generalization of other results.

The above synthesizes the need to develop this scientific article to promote environmental culture to achieve the protection of water resources in primary schools and in the communities where they are located. The research process presented in this article had as **general objective**: the implementation of a pedagogical strategy to develop environmental culture with a view to contribute to the protection of water resources by teachers in training at the San Luis Municipal University Center in the province of Santiago de Cuba.

It had more specific objectives which were:

1. To promote the understanding of the importance of water resource protection and its relationship with the environment, society and sustainable development.
2. To develop pedagogical skills to address the issue of water protection effectively in the classroom, adapting strategies and educational resources to the needs of students.
3. Encourage critical reflection and awareness of environmental issues related to water, promoting responsible attitudes and commitment to its protection.

Stimulate the active participation of teachers in training in concrete actions for water protection in their personal, educational and community environment.

Development

Theoretical foundation

The results provided in this research have been very positive, reliable and valid in order to contribute to the protection of water as a natural resource but sustained in the formation of an environmental culture where students in training from their jobs contribute to this significant work in order to protect life in its essence. Undoubtedly, the proposed objective is linked to the results from the achievement obtained, a redundant aspect in the development of other research on environmental education and its formation from the pedagogical context.

In a comparative way, the researches carried out in a great part of the world on the present subject have approached the study of natural resources from the educational institutions, especially those of higher level, with the intention of favoring the sensitization of all the professionals before the environmental problems, characterized by a creative, judicious, proactive and scientific thought.

Some of the latest exponent researchers from different countries regarding environmental education and the formation of a culture of this type have taken a line quite similar to those presented in this article alluding to the quality and protection of the environment and natural resources; some of these researchers with doctoral theses in their great majority are: González (2013), Ramos (2015), Villaverde (2021), Vega (2023), Ibáñez (2024), Ryad (2024), Santos (2024), UNESCO (2024) and Rey (2024), among others.

The above synthesizes that there is a relationship between the previous studies and the one shown by the researchers now constituting a priority at international level where the different authors mentioned have elaborated conceptions, models, methodologies and strategies derived from the scientific research developed, corroborating that, in their writing and styles there is similarity with respect to the protection of natural resources from the formation and work in action unit as part of environmental education; however, a low percentage emphasizes directly on the protection of water resources and the formation of an environmental culture, aspects that make this research very novel.

It is significant to state that the present research study is part of a doctoral thesis that responds to the Educational Sciences which is being developed by the main author of this article where with

all intentionality the relationship between the formation of environmental education and the full environmental awareness for the protection of the water resource is sought, indicative elements that still until now do not cease to be limitations in behavior and its total mobilization on the part of the teachers in training to achieve this water protection culture, taking into account the link between the inducing and executing sphere in unit with the unit with the teachers in training to achieve this water protection culture. still to this moment do not cease to be limitations in the behavior and its total mobilization on the part of the teachers in formation to achieve that protective culture of the waters taking into account the linking of the inducing and executing sphere in unity with the attitudes and values to mobilize towards a full behavior that consolidates the formation of convictions towards the environmental culture.

Methodology used

In order to carry out the study, a descriptive study was carried out, predominantly a research sustained by a quantitative and qualitative approach based on the analysis of bibliographic references of books, scientific articles, doctoral and master's theses, as well as the review of Study Plan D. The authors of this work took into account the design of this research, which was to know and evaluate the level of development of the environmentalist culture in the sample of teachers in training.

At the same time, theoretical methods were used, such as: analysis-synthesis, inductive-deductive, comparison and abstraction, which favored the introduction and analysis of the development of the work and its conclusions. These methods allowed the systematization and analysis of the bibliography, the conceptual interpretation of the empirical data. They were very advantageous in the interpretation of the theories referring to the treated subject, to understand the facts and to deepen in the essential relations of the non-observable processes.

The implementation of the Functional Structural Systemic Structural method favored the development of each of the parts of this research process, which was concretized in this scientific article where, from the whole to its parts, several core aspects were conceived for its better concretion, observed in the harmonic combination of its methodological structure and the operation in practice given the strategy of each one of them.

The empirical methods were represented by the structured questionnaire and the direct observation of the pedagogical practices of the teachers in training in order to establish the established diagnoses and their results before and after the pedagogical strategy was introduced.

Selection of the population and sample:

The study population was the 10 schools of the Consejo Popular Capitán San Luis as a source of information from the municipality itself with a total of 30 teachers in training for the bachelor's degree in primary education.

- A sample of 25 teachers in training for the bachelor's degree in primary education was selected.
- The sample was selected in a non-probabilistic way, using the convenience method, which implies that available and accessible participants were chosen for the research.

Stages for the development of the strategy

The proposed pedagogical strategy seeks to integrate environmental education into the teacher training curriculum, promoting critical reflection, awareness and action in relation to water protection. It was based on participatory, experiential and contextualized approaches that promote meaningful learning and the transfer of knowledge to real situations.

This pedagogical strategy consisted of several stages:

Objective: To organize in a scientific way the strategic process for the protection of water resources.

The stages of the strategy were

- 1- Initial diagnosis
- 2- Theoretical training,
- 3- Curricular analysis and development of actions
- 4- Practical experiences,
- 5- Accompaniment and evaluation (final diagnosis).

Initial Diagnosis Stage

Following the empirical methods, the diagnosis was carried out on the sample under study, which consisted of 25 teachers in training under the best conditions to obtain the desired results. The

questionnaire was administered to them, ensuring that it was answered individually and anonymously. A clear and detailed explanation was provided on how to complete the questionnaire and possible doubts were clarified.

At this stage, it was identified that the teachers in training had an average level of environmental culture with respect to water resource protection; although they showed a certain awareness of the importance of water conservation, there were limitations in terms of specific knowledge, practical skills and committed attitudes where their behavior was not participatory in terms of full interaction between theory and practice.

Several factors were known that influenced the behavior of teachers in training in this career in relation to water protection, such as: teacher training, personal attitudes and values, availability of resources, institutional support and awareness of the importance of the resource.

Partial conclusions: In general, although adequate theoretical knowledge and positive attitudes towards protection were observed, there were still challenges in the implementation of sustainable practices and the integration of environmental education in the school context capable of forming an environmental culture towards the protection of water resources. These findings are consistent with previous studies that highlight the gap between theoretical and practical knowledge.

Theoretical training stage

In this stage, a training activity was provided to teachers based on the results of the initial diagnosis to provide them with the fundamental knowledge about the importance of water protection and the associated challenges, as well as to provide them with the knowledge about the importance of water protection and the challenges associated with it.

Protection and the associated challenges and how to develop actions. During this stage, workshops, lectures and discussion activities were organized in which topics such as the importance of water as a vital resource, scarcity and pollution problems, and protection strategies were addressed, as well as case studies and practical examples that illustrated the relevance of the subject in the local and global context.

Stage of curricular analysis and development of actions

This stage involved the curricular integration of environmental education in the teacher training curriculum. The most relevant subjects and areas of study for addressing water protection were

identified, and activities and projects were designed to enable the teachers in training to apply the knowledge acquired in practical situations. For example, in the subject of Natural Sciences, experiments and laboratory practices were carried out that addressed topics such as water quality, filtration and purification.

In the subject of Environmental Education, community research projects were carried out that involved the trainee teachers in identifying and solving problems related to water in their environment.

The curricular analysis was also extended to other subjects, such as Language and Literature, Mathematics, and Social Sciences, where critical reflection and effective communication on the subject of water protection were encouraged. For example, in Language and Literature, debates were held and argumentative essays were written on the importance of protecting this resource and possible solutions to the associated problems. In Mathematics, data analysis activities were carried out on water consumption in the community and its relationship with environmental sustainability.

In Social Sciences, social and cultural aspects related to water use and management in different contexts was explored.

Stage of practical experiences

Practical activities outside the classroom were encouraged, such as visits to water treatment centers, nature reserves or communities that have implemented successful water protection practices. These experiences allowed the teachers in training to put their knowledge into practice and establish real connections between theory and practical reality.

Accompaniment and evaluation stage

During implementation, tutors or supervisors will be assigned to provide guidance and feedback to the trainee teachers. The authors of this research were responsible for conducting classroom observations, reviewing and evaluating the activities developed, and providing recommendations for improving teaching and learning. In addition, periodic evaluations were conducted to measure the progress of the teacher trainees and to make necessary adjustments to the strategy. The evaluation proceeded on the basis of the aspects listed below:

A) Variables used to evaluate strategic development:

Response variables were conceived as the dependent variable: development of the environmentalist culture achieved by the teachers in training of the primary education career regarding the need for water resource protection; the same was operationalized as follows:

1. *Theoretical knowledge*: evaluation of theoretical knowledge on the importance and responsible use of water resources.
 - ✓ Indicator: Level of knowledge about concepts related to water protection.
 - ✓ Parameters: High, medium, low.
2. *Attitudes and values*: Evaluation of attitudes and values toward water protection.
 - ✓ Indicator: Level of environmental awareness and concern for water protection.
 - ✓ Parameters: High, medium, low.
3. *Practices and behaviors*: Evaluation of practices and behaviors related to water use and care.
 - ✓ Indicator: Level of adoption of sustainable practices and water protection measures.
 - ✓ Parameters: High, medium, low.

To define the results as high, medium and low levels, the individual results were compared with the standards established for each indicator; previously defined criteria were used that indicate score ranges for each level of development of the environmental culture in the specific variable of water resource protection. Thus, the results were classified as follows:

- High level: participants obtained a score indicating solid theoretical knowledge, positive attitudes and values towards water protection, as well as sustainable practices and behaviors related to its use and care.
- Average level: Participants who showed this level in the indicators evaluated demonstrated acceptable knowledge and awareness, although with room for improvement in some specific areas.
- Low level: Participants in this indicator reflected insufficient knowledge, unfavorable attitudes, and inadequate practices regarding water protection

Data analysis:

- A quantitative approach was used to analyze the data collected.
- Scores were assigned to the responses according to the established indicators and parameters.

- An average score was calculated for each participant on the water resource conservation variable.
- Based on the average scores, the level of development of environmental culture was determined for each participant.

The data collected were analyzed in an integrated manner and triangulated to obtain a complete and enriching view of the environmentalist culture of the teachers-in-training in relation to water resource protection.

Main results

From the implementation of the pedagogical strategy through its different stages, the results were the following from the empirical methods such as the structured questionnaire and the direct observation of the pedagogical practices of the teachers in training,

Implementation of the rest of the stages and their results.

1. Theoretical training-There was an adequate acceptance of the training received by the teachers in training, which resulted in an acceptable behavior in the development of the workshops, allowing them to be sensitized to be able to implement in their classes the protection of water resources. And to go forming an environmental culture.
2. Curricular analysis and development of actions--- The analysis of the programs corroborated that there was a lack of specific actions to be able to establish a relationship between the content, which allowed curricular adjustments to be made to treat it in the teaching-learning process. The actions from each of the subjects allowed for the care of the coexistence environment of each student and the protection of water.
3. 16- Practical experiences-These resulted in being able to establish a much more specific relationship between theory and practice by learning how to act from the school in the protection of water resources, from family coexistence to the agreement with agricultural companies to prevent water pollution.

Accompaniment and evaluation--- The follow-up process by the researchers to each of the actions mentioned brought about significant changes in the behavior of the teachers in training towards their students by observing empathy, socialization, exchange and active participation in each of the activities.

Final diagnostic stage

After the implementation of the pedagogical strategy, it was observed that the results showed significant progress in all the dimensions evaluated, demonstrating the effectiveness of the intervention in the formation of the environmental culture that is the essence unified to the protection of water resources.

- In relation to knowledge, it was found that the teachers in training acquired a greater mastery of concepts related to water conservation. They now have a more solid understanding of the water cycle, the importance of its responsible use, the consequences of its contamination and the need to promote its conservation.
- In terms of practical skills, a substantial development was observed, as 100 % of the trainee teacher's demonstrated greater mastery in the implementation of concrete techniques and practices for water conservation. These include the efficient use of water at home, the adoption of reuse and recycling measures, as well as the promotion of responsible habits among their students.
- In terms of attitudes, a positive change in the perception of the participants was identified in 100% of the sample under study. Now, the teachers in training show a greater awareness and commitment to water conservation, reflecting a more proactive and responsible attitude in their relationship with this vital resource.
- In addition, there was evidence of an effective integration of environmental issues in the teaching practice of the 25 teachers in training, with 100% effectiveness. They are now able to design and develop educational activities that promote an environmental culture, incorporating water conservation in a cross-cutting manner in their curricular planning.

In terms of practices and behaviors, 100 % of the teachers in training in relation to water conservation, after implementing the strategy experienced substantial changes in relation to active engagement in the adoption of sustainable practices, such as the efficient use of water and the promotion of related educational activities. All participants were optimistic and willing to apply more sustainable practices in their daily lives.

Conclusions

The theoretical aspects that are collected in the introduction, as well as in the first part of the rationale contributed to be able to consider that there have been several studies related to the

protection of the environment and with it the protection of the water resource so valuable for the very existence of living beings on Earth.

In a successful way and with the combination of theoretical and empirical methods based on the Functional Structural Systemic, the desired objective was achieved with the instrumentation of a pedagogical strategy applied to develop the environmental culture by the teachers in training of the Municipal University Center of San Luis in the province of Santiago de Cuba in order to contribute to the protection of the water resource where the mobilization of students for this purpose was achieved in a theoretical and practical way.

Under the same conditions, the protection of water resources as part of the environment was promoted, contributing to society and sustainable development from the relationship of dependence and interdependence between theoretical training, curricular analysis and the development of actions, achieving practical experience with greater development of motivation and entrepreneurship to act from the interests and willingness to preserve life on Earth.

The above aspects corroborated the relevance of the development of pedagogical skills to address the issue of water protection effectively in the classroom, adapting strategies and educational resources to the needs of students but in a much more creative way from the curricular to the extracurricular, encouraging critical reflection and awareness of environmental issues related to water, promoting responsible attitudes and commitment to its protection not only to students but leading to the active participation of teachers in training in concrete actions to protect water in their personal, educational and community environment.

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